THE ENDOWMENT OF RESEARCH IN FRANCE.

AT the meeting of the Paris Academy of Sciences on April 27, the Secretary read the following extract from the will of the late M. Cahours:—

"I have frequently had the opportunity of observing, in the course of my scientific career, that many young men, distinguished and endowed with real talent for science, saw themselves obliged to abandon it because at the beginning they found no efficacious help which provided them with the first necessities of life and allowed them to devote themselves exclusively to scientific studies.

"With the object of encouraging such young workers, who for the want of sufficient resources find themselves powerless to finish works in course of execution, and in remembrance of my beloved children, who also would walk in a scientific path at the moment when death takes me from them, I bequeath to the Academy of Sciences, which has done me the honour to admit me into its fraternity, a sum of one hundred thousand francs.

"I desire that the interest of this sum may be distributed every year by way of encouragement to any young men who have made themselves known by some interesting works, and more particularly by chemical researches.

"In order to assure this preference, independently of the express recommendation that I make here to my successors, I wish that, during at least twenty-five years after the commencement of the interest payable to the Academy, three members at least of the Chemistry Section may take part each year in a Commission of five members charged by the Academy to distribute the prizes. I express further the formal desire that this choice should fall, as far as possible, on young men without fortune not having salaried offices, and who, from the want of a sufficient situation, would find themselves without the possibility of following up their researches.

"These pecuniary encouragements ought to be given during several years to the same young men, if the Commission thinks that their productions have a value which permits such a favour.

"Nevertheless, in order that the largest number of young workers may participate in the legacy I institute, I desire that the encouragements may cease at the time when the young *savants* who have enjoyed them obtain sufficiently remunerative positions."

M. Janssen then made the following remarks:—

"The legacy which has been made to the Academy, by our very eminent and very regretted *confrère*, appears to me to have considerable import not only by its importance, but especially by the way that it opens, and the example that it affords, to all those who hereafter may desire to encourage the sciences by their liberality.

"M. Cahours, whose sure judgment and long experience enabled him to know the most urgent necessities of science, had, like most of us, become convinced of the necessity of introducing a new form in the institution of scientific recompenses.

"Our prizes will always continue to meet a great and noble necessity; their value, the difficulty of obtaining them, and the *éclat* they take from the illustriousness of the body which awards them, will make them always the highest and most envied of recompenses.

"But the value, also, of the works it is necessary to produce in order to lay claim to them prohibits the research to beginners. It is a field that is only accessible to matured talents.

"But, besides those *savants* who have already an assured career, there are many young men endowed with precious aptitudes, and directed by their inclination to pure science, but turned very often from this envied career by the difficulties of existence, and taking with regret a direction giving more immediate results. And yet, how many among them possess talents which, if well cultivated, might do honour and good to science!

"We must say, however, that it is in leaving their studies that those who wish to devote themselves to pure science experience the most difficult trials, and these difficulties are increased every day by the very rapid advance of the exigencies of life.

"We must find a prompt remedy for this state of things if we do not wish to see the end of the recruitment of science.

"This truth, however, is beginning to be generally felt. The Government has already created institutions, scholarships, and encouragements, which partly meet the necessity. Some generous donors are also working in this manner. I will mention especially the noble foundation of Mdlle. Dosne, in accordance with whose intentions a hall is at this moment being built, where young men, having shown distinguished aptitudes for high administration, the bar, or history, will receive for three years all the means of carrying on high and peaceful studies.

"Let us say, then, plainly, and in speaking thus we only feebly echo the expressions of the most illustrious members of the Academy, that it is by following the way so nobly opened by Cahours that the interests and prospects of science will be most efficaciously served."

NOTES.

A SPECIAL meeting of the Physical Society of London will be held at Cambridge on Saturday, May 9. The members will leave Liverpool Street at 11 a.m., and on arrival at Cambridge will become the guests of the Cambridge members. The meeting will be held in the Cavendish Laboratory at 2.30. The following communications will be read: some experiments on the electric discharge in vacuum-tubes, by Prof. J. J. Thomson, F.R.S.; some experiments on ionic velocities, by Mr. W. C. D. Whetham; on the resistance of some mercury standards, by Mr. R. T. Glazebrook, F.R.S.; on an apparatus for measuring the compressibility of liquids, by Mr. S. Skinner; some measurements with the pneumatic bridge, by Mr. W. N. Shaw. After the meeting members will have an opportunity of seeing the Cavendish Laboratory and other University Laboratories.

THE annual meeting of the Iron and Steel Institute began yesterday, and will continue to-day and to-morrow. It is being held as usual at the Institution of Civil Engineers in Great George Street.

A VALUABLE bequest has been made to the Department of Science and Art by the late Miss Marshall, of 92 Warwick Gardens, Kensington. In addition to a large number of scientific books and instruments which are left for the use of students, a sum of £1000 is bequeathed for the founding of scholarships, or for application in any other way that may be considered best for the advancement of biological science.

THE Queen has approved the appointment of Lord Derby to be Chancellor of the University of London, in the room of the late Lord Granville.

THE death of Prof. Joseph Leidy, in his sixty-eighth year, is announced. He was Professor of Anatomy in the University of Pennsylvania and of Natural History in Swarthmore College; President of the Academy of Natural Sciences of Philadelphia; and Director of the Department of Biology in the University. In a future number we shall give some account of his services to science.

A REUTER'S telegram from New York, dated May 1, announces the death, at Berkeley, California, of Prof. John Le Conte, brother of Mr. Joseph Le Conte, formerly professor of geology and natural history in the University of California.

WE regret to have to announce the death of Captain Cecilio Pujazon, the Director of the Marine Observatory of San Fernando, near Cadiz. He died on April 15, in his fifty-seventh year. Captain Pujazon was well known to the members of the Eclipse Expedition of 1870, who formed the Cadiz party. He came to London to the Conference on Marine Meteorology in 1874.

IN answer to a question put by Mr. H. Fowler in the House of Commons on Monday, Sir W. Hart Dyke said that from the returns already received, in answer to a circular issued by the

Science and Art Department at the end of March last, it appeared that of the fifty county councils and sixty county boroughs in England, sixteen of the former and twenty-five of the latter had already decided to apply the whole of their share of the residue under the Local Taxation (Customs and Excise) Act of 1890 to science and art and technical education. Nine county councils and two county boroughs had made grants varying from "nearly the whole" to a smaller proportion of their share to the same purpose. Twelve county councils and seven county boroughs had the matter under consideration; that is to say, they had appointed committees, and in many cases the committees had recommended the allocation of the whole or the greater part of the residue fund to technical instruction, but their reports had not yet been confirmed by the county or borough councils. With regard to Wales, the question was complicated by the fact that the Welsh Intermediate Education Act included technical instruction, but it appeared that four county councils and one county borough had applied the whole of their share of the residue under the Intermediate Education Act; while two county councils and one county borough had divided their quota between that Act and the Technical Instruction Act. The remaining six county councils had either made no return, or else had the matter under consideration.

THE Council of University College, Bangor, having resolved to make provision in the physical department (Prof. A. Gray) for the study of applied electricity, an 8 horse-power (nominal) compound engine, working up to 24 horse-power, has just been installed by Messrs. Robey and Co., Lincoln. On Saturday last a satisfactory trial of the engine and boiler was made. The equipment includes a special educational Victoria dynamo (capable of being converted at will into a shunt, compound-wound, or series dynamo, without impairing its usefulness for general work), by the Brush Electrical Engineering Co., an alternating dynamo, and a large secondary battery. The electrical measuring instruments are of the latest design, and include a fine composite balance, and electrostatic voltmeter of Sir William Thomson's invention. The equipment forms a valuable addition to the resources of the College for the teaching of pure and applied physical science, and will render it possible to give a very complete course of instruction in electrical engineering, as well as in the general theory of electricity.

THE Philosophical Society of Berlin offers a prize of 1000 marks for the best essay on the relation of philosophy to the empirical science of nature. The essays may be written in German, French, English, or Latin, and must be sent in before April 1, 1893.

THE Italian Meteorological Society has celebrated its twenty-fifth anniversary by erecting a memorial tablet in the mediæval castle of Turin. The founder of the Society, Father Denza, and various notabilities and ladies were present. Father Denza gave a *résumé* of the history of the Society, which now possesses no less than 250 observatories and stations. The ceremony was terminated by the transmission of a telegram to the King, as Honorary President of the Society.

THE Chief Signal Officer of the United States has published Part III. of "Bibliography of Meteorology," comprising titles relating to the general motions of the atmosphere, or "winds," while the important division of "storms" is being prepared for issue as Part IV. The present volume, like its predecessors, is a lithographic reproduction of a copy prepared by means of a type-writer, as funds were not forthcoming for printing the work, and it contains a total of 2000 titles of books and papers dating from the origin of printing to the close of 1881, with a supplement to the close of 1889, and an author index. The work is quite unique, and will be an invaluable aid to the study of the subject treated of.

AN account of the Birmingham School of Medicine, written originally for the information of those members of the medical profession who attended the Birmingham meeting of the British Association in 1890, has now been published separately. The authors are Dr. B. C. A. Windle and Mr. W. Hillhouse. Their intention is to show—and this they do most effectually—that the centre of the Midland district possesses one of the best equipped schools of medicine in the provinces. The interest of the descriptions is greatly increased by reproductions of some photographs.

A FISH and Game Commission, taking evidence on behalf of the Ontario Government, has received many complaints as to the destruction of deer and other depredations by wolves; and all the witnesses agree that the present bounty of £1 paid for each wolf killed should be raised to £2 10*s*. or £3. It has also been shown that, if the game laws are not more strictly enforced, many birds and fur-bearing animals will probably be exterminated.

THE preliminary returns of the recent census operations in India show that the population in British territory is 220,400,000, as against 198,655,600 in the former census, an increase of nearly 22,000,000. The Feudatory States, omitting incomplete returns, which may be taken at about 90,000, have a population of 61,410,000, making a total of 281,900,000, as against 250,700,000 for the same areas at the last census. The returns give Bombay 806,000, Madras 449,000, Calcutta municipal area and port 674,000, and including the suburbs Howrah and Bally, 969,000. At the last census the total for the same area was 847,000. Calcutta municipal area shows an increase of 92,000, and Howrah and Bally an increase of 24,000. The returns from Burmah show that the population of the whole country, excluding the Shan States, is 7,507,063, or 48·8 persons to the square mile. The population of Lower Burmah alone is 4,526,432, or an increase of about 790,000 since 1881.

THE Boston Society of Natural History has issued a pamphlet announcing the completion of the general plans for the formation of zoological gardens and aquaria in Boston, and appealing to the American public for support. The pamphlet is prettily printed and illustrated, and sets forth very effectively the arguments which may be advanced in favour of the scheme.

THE new number of the Journal of the Royal Horticultural Society contains a full report of the Dahlia Conference, held at the Chiswick Gardens on September 23 last; and of the Grape Conference, held in the same Gardens on September 24. The number also contains valuable papers on various other subjects interesting to horticulturists.

THE Trustees of the Indian Museum, Calcutta, have issued an interesting and instructive Report, by Mr. E. C. Cotes, on the locust of North-Western India (*Acridium peregrinum*). The Report sums up the results of an investigation conducted in the entomological section of the Museum. It seems to be established that most of the flights of this locust issue from the region of sand-hills in Western Rajputana. Others, however, invade India from breeding-grounds which probably lie along the Suliman Range, or even, perhaps, in some cases, beyond India's western frontier, in the sandy deserts of Baluchistan, Southern Afghanistan, and Persia, though the reports received from these regions, Mr. Cotes says, are so fragmentary that no very definite conclusions can be formed from them.

THE *New Zealand Journal of Science*, the publication of which was suspended in 1885, has been revived. The first two numbers of the new issue have been sent to us, and if the same general level of excellence can be maintained in future numbers, there ought to be no doubt as to the success of the enterprise. The following are among the papers: on the history of the

Kiwi, by Prof. T. J. Parker; on the breeding habits of the European sparrow in New Zealand, by T. W. Kirk; the humble-bee in New Zealand, by G. M. Thomson; some notes on the occurrence of the trap-door spider at Lyttelton, by R. M. Laing; on the discovery of the nickel-iron alloy Awaruite, by Prof. G. H. F. Ulrich.

IN the paper on the humble-bee in New Zealand, Mr. Thomson says that, wishing to find how far these insects are adapting themselves to new flowers in the colony, he has for a considerable time kept a record of the flowers they visit and of those they leave alone. He has noticed them on many species of introduced plants which they never appear to visit in Europe. They seldom approach white flowers; and, with two exceptions, he has never heard of their visiting the flowers of indigenous plants. The exceptions are *Fuchsia excorticata* and the Ngaio (*Myoporum lætum*).

MESSRS. R. ETHERIDGE, JUN., AND MR. A. SIDNEY OLLIFF have produced in common a paper which forms a valuable addition to the Memoirs of the Geological Survey of New South Wales. The title is "The Mesozoic and Tertiary Insects of New South Wales."

MESSRS. BAILLIÈRE, TINDALL, AND COX publish a second edition of Dr. Thomas Dutton's practical treatise on "Sea-Sickness." Sensible readers will at once be favourably impressed by the author's statement that there is "no absolute specific" for this distressing malady.

MESSRS. CASSELL AND CO. have issued Part 31 of their "New Popular Educator," which will be completed in 48 parts. Besides illustrations in the text, there is a carefully prepared page representing coloured reactions characteristic of certain metals, &c.

MR. T. H. CORNISH, of Penzance, has a note in the current number of the *Zoologist* on some remarkably large catches of fish on the Cornish coast. On March 18 last, 12,000 grey mullet, *Mugil capito*, were captured, by means of a draw-seine, by the fishermen of Sennen Cove, at Whitsand Bay, Land's End. The fish were of fine quality, one being brought to Mr. Cornish which measured 2 feet in length, 1 foot 3 inches in girth, and weighed 6 pounds 10 ounces. On the 31st of the same month a Lowestoft mackerel driver, fishing some leagues south-west of the Lizard, took 48,000 mackerel. No such catch of mackerel, for one night's fishing, had ever been heard of before at Penzance, and what makes it more extraordinary, says Mr. Cornish, is that it should have taken place in March, when the catches usually average a few hundreds only. Later on in the season, in the fishing west of Scilly, 20,000 to 25,000 is regarded as a heavy catch. The catch sold for £360.

WITH reference to our note (vol. xliii. p. 521) on an award made by the Japanese Government to Dr. Shohei Tanaka for "the invention of a new musical instrument," Mr. J. W. Goundry, of Gosforth, Newcastle, writes to us that over twenty years ago he patented an arrangement for giving enharmonic intervals in all keys on the ordinary unaltered keyboard, and that he has had both an organ of 31, and a harmonium of 36, sounds per octave, playing Bach's fugues and Handel's choruses, &c., on the system. He claims that, although his patents were very crude and imperfect, they contain at least the germ of a complete solution of the problem of reconciling just intonation with the ordinary manual. "They embody a system of sounds," he says, "which I believe to be theoretically the truest and practically the simplest possible, and which has nowhere else been described."

AMMONIUM sulphovanadate, $(NH_4)_3VS_4$, has been isolated in large crystals by Drs. Krüss and Ohnmais, and an account of their work, which also includes the preparation of several other sulpho-salts of vanadium, will be found in the latest number of *Liebig's Annalen*. It is well known that when ammoniacal solutions of vanadates are treated with sulphuretted hydrogen a magnificent purple colouration is produced, presumably due to the formation of sulpho-salts. It has not been found possible, however, to obtain such salts by crystallization *in vacuo*. The method of obtaining the ammonium salt now described is as follows:—A stream of sulphuretted hydrogen is led into an ice-cold saturated solution of ammonium metavanadate, NH_4VO_3, in the strongest ammonia. The immediate effect is to produce the violet-red colour, but the colouration soon disappears and a brown solid is precipitated. On continuing the passage of the gas this precipitate slowly redissolves with production again of the deep violet colour. When the re-solution of the precipitate is almost complete the liquid is filtered, and sulphuretted hydrogen again led through the solution. In a short time crystals commence to separate, when the current of gas is stopped and the liquid left to crystallize in a closed vessel. The crystals thus obtained consist of opaque rhombic prisms very much resembling in appearance those of potassium permanganate. The faces are very brilliant and reflect a steel bluish-violet colour with a greenish tint when the reflection is received at a certain angle. They may be washed with absolute alcohol and afterwards with ether, and finally dried *in vacuo*. The mother liquors from the first crystallizations deposit magnificent crystals on being allowed to stand some weeks. The substance may be much more quickly obtained and in larger quantity by substituting either potassium or sodium vanadates for the ammonium vanadate used in the above mode of preparation, as these salts are much more soluble in ammonia than ammonium vanadate. It is somewhat remarkable that in this case pure ammonium sulphovanadate should be obtained, no potassium or sodium sulpho-salts being ever found in the product. The crystals of ammonium sulphovanadate are permanent in dry air, but are slowly decomposed with evolution of sulphuretted hydrogen in moist air. They are readily soluble in water, forming a solution which is coloured intensely violet even when very dilute. A solution containing only one part of the salt in 100,000 parts of water still possesses a beautiful rose-red colour. After a short time this solution decomposes, sulphuretted hydrogen being liberated and the colour changing to brown. When a freshly prepared solution is added to a solution of a salt of the alkaline earthy metals, no precipitate is produced, owing to the solubility of the sulphovanadates of these metals. But in the case of calcium a remarkable deepening of the violet colour is produced. If, for instance, a little calcium chloride is added to a dilute solution possessing a just perceptible rose tint, the colour becomes immediately deep violet, owing to the extreme tinctorial power of the calcium salt.

IN our note in vol. xliii. p. 592, upon the preparation among other silicon compounds of silicon chloro-tribromide, $SiClBr_3$, by M. Besson, it was stated that this substance had not been hitherto prepared. We wish to correct this statement. Silicon chloro-tribromide was prepared by Prof. Emerson Reynolds in 1887, and a descriptive note of the work was given in NATURE at the time (vol. xxxvi. p. 137).

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀) from India, presented by Mrs. Emily Palmer; two Brazilian Caracaras (*Polyborus brasiliensis*) from Terra del Fuego, a Turkey Buzzard (*Cathartes aura*) from the Falkland Islands, presented by Mr. F. E. Cobb, C.M.Z.S.; two Herring Gulls (*Larus argentatus*), British, presented by Mrs. Attenborough; a Pine Grosbeak (*Pinicola enucleator*), British, presented by Mr. W. H. St. Quintin; a Bennett's Wallaby (*Halmaturus bennetti* ♂) from Tasmania, two Diamond Snakes (*Morelia spilotes*) from Australia, deposited; two Tasmanian Wolves (*Thylacinus* *cynocephalus* ♂ ♀), three Ursine Dasyures (*Dasyurus ursinus* ♂ ♀ ♀) from Tasmania, two Brush Turkeys (*Talegalla lathami* ♂ ♀), four Australian Wild Ducks (*Anas superciliosa*) from Australia, received in exchange; a Black Lemur (*Lemur macaco*), two Persian Gazelles (*Gazella subgutturosa*), born in the Gardens.

THE INSTITUTION OF MECHANICAL ENGINEERS.

On the evenings of Thursday and Friday of last week, the 30th ult. and the 1st inst., the Institution of Mechanical Engineers held an ordinary general meeting; the President, Mr. Joseph Tomlinson, occupying the chair. There was an attendance of members somewhat in excess of that which is usual at the ordinary meetings of this Institution. There were two items on the programme—namely, a paper on Lancashire boilers, and a further report from the Research Committee on Marine Engine Trials. The discussion of the latter occupied so much time that the boiler paper had to be shelved until next meeting.

The latest steamer upon which the Marine Engine Research Committee has been experimenting is a cargo vessel named the *Iona*. She was built and engined by W. Gray and Co., of West Hartlepool, and is a good modern example of what can be done in fuel economy with triple expansion engines when high speed is not aimed at. This latest report of the Committee should re-establish in some minds the belief in the economy of the marine surface-condensing engine, which had been, so it was thought, rather shaken by the previous labours of the Committee. When on the first trials of the Committee the fuel consumption of the *Meteor*, *Fusi Yama*, and the *Colchester* came out at not less than 2 pounds of coal per indicated horse-power per hour—the *Colchester's* consumption being nearly 3 pounds per hour—it was said, by those who had never believed in the claims of marine engineers, that the bubble was pricked by a trial made by competent and unbiassed persons. It is true the *Tartar's* trial improved on these figures, the coal consumption coming out 1·77 pound per indicated horse-power per hour; still this is some way behind the 1¼ pound of which marine engineers had been boasting. The experiments with the *Iona*, now under consideration, have rehabilitated the marine engine as an economical form of steam motor, for there can be no doubt that the engines of that vessel have given off on trial one unit of power per hour for less than the pound and a half of coal, and we have no reason to think that the 1·38 pound shown on the chief engineer's independent trial is not a fair average for sea running when the disturbing element of measuring tanks is omitted.

The *Iona* is a well decked vessel, built in 1889. She has triple expansion engines on three cranks, working a single screw. The vessel is 275·1 feet long, 37·3 feet wide, and 19 feet deep in the hold. Her moulded depth is 21 feet 10 inches, and her coefficient of fineness is 0·765. She has a cellular bottom. Her mean draught in dock before trial was 20 feet 8 inches, but she rose half an inch in salt water, the displacement being 4430 tons. The engines had been freshly overhauled. The trial took place off the east coast, between Robin Hood Bay and Great Yarmouth. The weather was fine throughout. The engines are triple compound surface condensing. The cylinders are placed in the order—intermediate, high, low, going from forward to aft. The cranks rotate in the sequence—high, intermediate, low. The diameters of the cylinders are 21·88 inches, 34·02 inches, and 56·95 inches; the stroke is 39 inches. The high pressure cylinder only is jacketted, steam being taken from the boiler direct. Outside this jacket are the receivers for the intermediate and low pressure cylinders. The jacket steam therefore parts with heat to the high pressure cylinder, and also heats up the steam passing to the two other cylinders. The arrangement is unusual but not new. A feature worth noting in the present day is that the steam distributing valves are all slide valves. Mr. Mudd, the designer of the engines, does not follow the modern fashion of using piston valves, it being his belief that the advantages they offer are not equal to those lost. The surface condenser has 1360 square feet of tube surface. There are two ordinary steel boilers having 42 square feet of grate surface, the total heating surface being 3160 square feet; which is equal to 75·2 times the grate area. It is not to be wondered at that, with this liberal allowance of heating surface, the fuel economy came out very satisfactorily. The total cross-sectional area through the tubes is 18·3 square feet, and the area across the funnel 30·7 square feet. A notable feature about this vessel is that the boilers are worked on forced draught; or rather there is a fan for supplying air to the fires, for a pressure equal to only 0·17 inch of water in the ash pits hardly fulfils the popular notion of forced draught. The steam for driving the fan-engine was supplied from the donkey boiler, and therefore the measurements of quantities in the performance table were not affected by the amount of steam used by the fan. The matter is not one of great importance—the power to drive the fan not being, perhaps, more than the three-hundredth part of the power of the propelling engines; but we question whether it is strictly fair—as comparing the *Iona's* machinery with that of other vessels—not to take the fan-engine steam from the main supply. The boilers in this ship have an extraordinarily large proportion of tube surface as compared to the grate surface, and this would be likely to lead to an insufficiency of draught were the lighter specific gravity of the chimney gases alone depended upon. If, therefore, the aid of the fan has to be brought in, its cost as well as its services should be taken into account. This is looking at the matter from the point of view of taking the total efficiency of the machinery, and Prof. Kennedy might very justly urge that the steam used by the fan would be a disturbing element, and prevent him from properly determining the efficiency of the engines. The fan undoubtedly belongs to the boiler, but not more so than the feed-pumps; all boilers, however, must have feed-pumps, while comparatively few have fan-engines. If ever it comes to be that fan-engines are almost as much matters of course as feed-pumps, it will be convenient to class the former with the engine, but until then it is as well to estimate the steam required for forced draught purposes by itself; still it should be taken into account.

The air from the fans is taken to the furnace through gridiron valves, which close automatically when the furnace-door is opened, so as to prevent a rush of flame into the stokehold. A small jet of air is also admitted through the wet end of the boiler back by a passage made for the purpose. In this way there are two streams of air which meet in the combustion-chamber. There is also a hanging bridge attached to the back tube plate, and depending into the flame box at the back of the bridge. By these arrangements a very thorough mixing of the air and furnace gases is secured; and to this, no doubt, is due the unusually perfect combustion which was obtained on the trial. The small grates give additional space for the mixing and burning of the gases before they enter the tubes, a most desirable feature in boiler design, and one which should do much to put the cylindrical flues of modern high-pressure boilers on an equality, in the matter of combustion, with the rectangular furnaces of the comfortable low-pressure days of the past generation of marine engineers. At the same time we must not forget that a large amount of fuel burnt on a small grate requires a large combustion chamber. It is the volume of gases evolved which has to be considered. It should be stated that the arrangement for forced draught was designed by Mr. J. R. Fothergill, of Hartlepool, engineer superintendent to the firm owning the ship.

It is so difficult to get accurate data upon the weight of marine engines, that we add the figures given in the report:—

	Tons.
Engines alone	94·92
Shafting, tunnel-bearings, and propeller ...	26·59
Engine-room auxiliaries, including donkeys, pipes, platforms, ladders, and gratings ...	12·16
Boilers alone	58·60
Boiler-room auxiliaries, including forced draught gear, smoke-box, uptake, funnel, furnace gear, mountings, stokehold floor, boiler-chocks, and ties...	28·49
Water in boilers	35·75
Total	228·22

The coal used was of good quality. The following analysis (as used) will be of interest:—

	Per cent.
Carbon	82·34
Hydrogen...	5·47
Moisture	1·94
Ash	2·90
Nitrogen, sulphur, oxygen, &c., by difference...	7·35
	100·00